Prediction Model

Create and Maintain Prediction Models

Building Family Models

The essence of the prediction modeling (family modeling) process is to identify and group pavements of similar construction that are subjected to similar traffic patterns, weather, and other factors that affect pavement life. The historical data on pavement condition can be used to build a model that can accurately predict the future performance of a group of pavements that possess similar attributes. This model of pavement life is assigned a name, and in the PAVER vocabulary it is referred to as a "family."

Each pavement section in PAVER is assigned a family. When predictions about the future performance of a pavement are desired, a section's family assignment is used to predict a section's future condition. If the user has not assigned a family model to a section, PAVER will use its default family to predict future pavement performance.

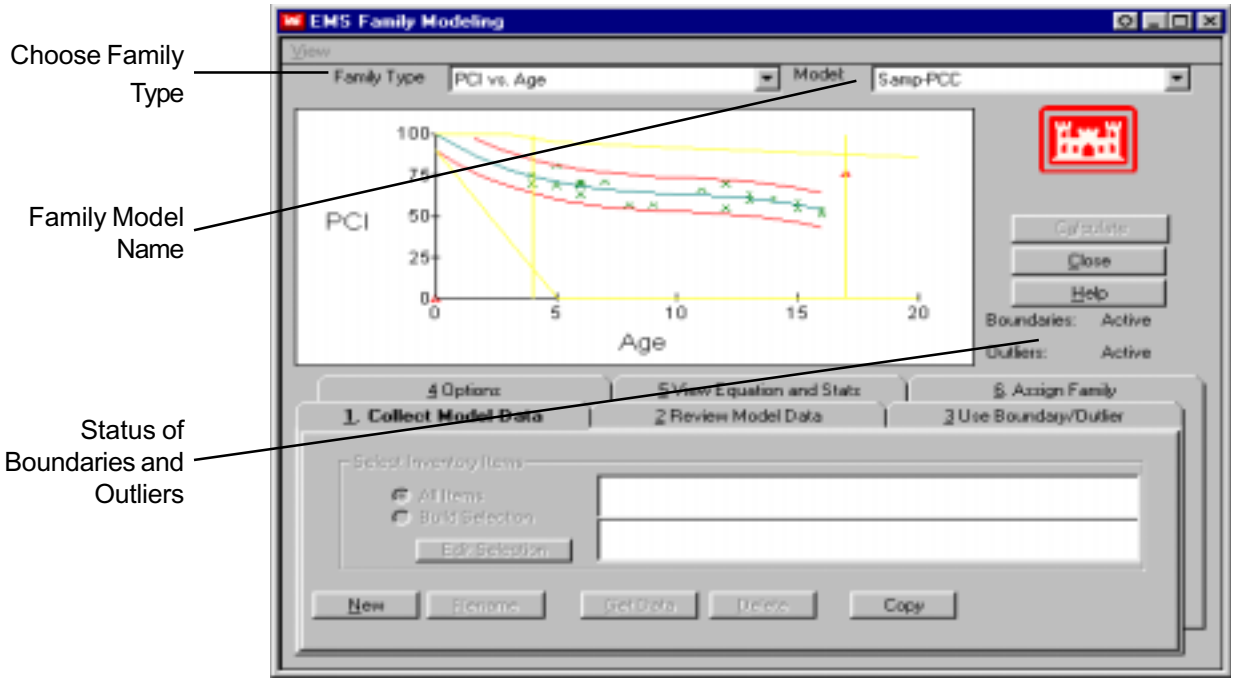
However, factors such as original construction, maintenance, weather, and traffic, greatly affect the life of a pavement and a generic guess, one of which is the default family, is not likely to be as accurate as a model that takes these factors into consideration. The **Prediction Model** is designed to allow users to blend unique knowledge about their pavements, measured local condition information, and powerful modeling tools together to produce highly accurate estimates of future pavement life.

Note

When selecting a model, scroll and type seek capabilities are available if the number of saved models exceeds the length of the list.

Using the Prediction Model

Click on the **Pred. Modeling** button on the PAVER button bar. The **Prediction Model** can also be reached via the **Visual Menu**. A window titled "EMS Family Modeling" appears. The top half of the form is a graph that shows a sample start-up prediction model. Two drop-down boxes are located above the prediction model graph. By clicking the arrow on the right side of these boxes, you can select a **Family Type** and a saved prediction model. Select a model from the list. When you select a model, PAVER loads all the data points used to build the model and the settings used to generate the model. It then plots the data points and the estimated condition prediction function.



The upper right corner of the **EMS Family Modeling** form contains three buttons: **Calculate**, **Close**, and **Help**. The **Calculate** button causes the model to estimate the condition prediction function and plot the curve through the data points. The **Close** button closes the **EMS Family Modeling** window. Any models you have built are automatically saved when the **Close** button is clicked. "Help" is launched by clicking the **Help** button. The prediction model plot operates like other PAVER graphs. A right click on the graph displays the extended graphing features menu.

Located just below the **Help** button are the **Boundary** and **Outliers** status indicators. Once a model is selected or created, the **Boundary** and **Outliers** status indicators are activated. These indicators report the status of the boundary data filter located on card **3. Use Boundary/Outlier**, and the statistical outlier analysis feature that is configured on card **4. Options**. These options, and all other family model building variables, are configured on the index card style data entry forms located on the lower half of the **EMS Family Modeling** form.

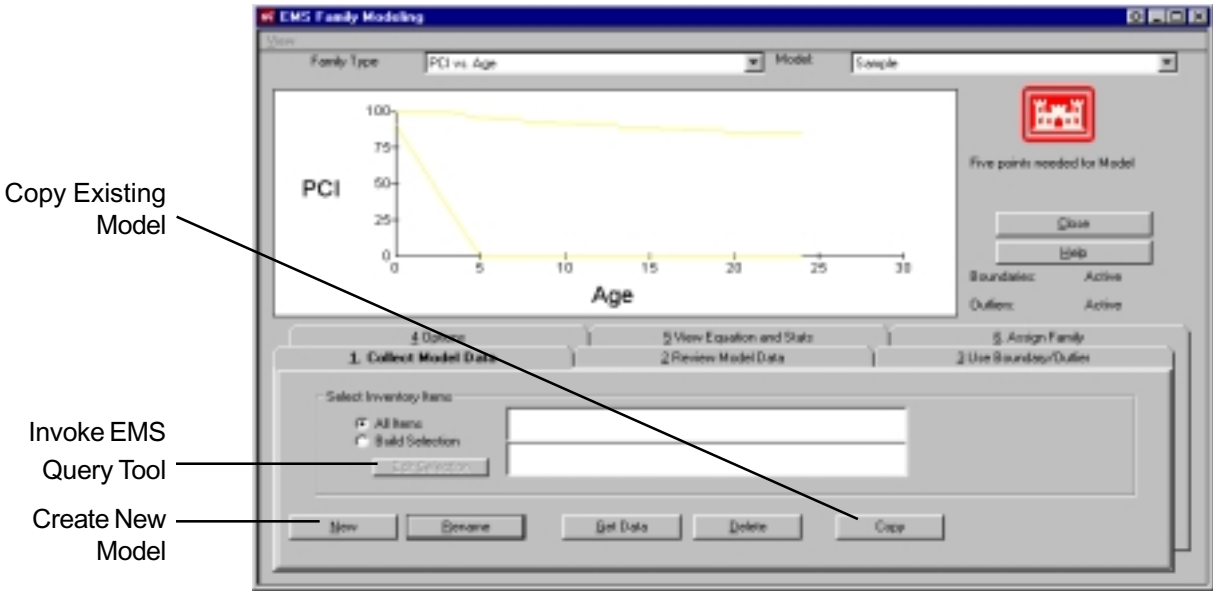
Collect Model Data

Note

When a prediction model is created, only data points that are at least one year old are used.

This form is used to collect data from the active PAVER database and in order to build a new family model or to adjust an existing family model. To create a new model, click the **New** button. You are prompted to provide a name for the new family model being created (entries may be up to 16 characters in length). After naming your family model and clicking **OK** on the **Create New Model** form, the **EMS Query Tool** is presented so that you may select a subset if desired of the active database. After selecting the filter criteria (which can be none), the age verses condition points for the pavement sections selected are placed in the grid on the **Review Model Data** card as well as displayed on the graph.

The **Get Data** button at the bottom of the **Collect Model Data** card is used to modify the data used in an existing family model. After you click the **Get Data** button, you are prompted to overwrite the existing model data, append to (add to) the existing data, or abort the get data operation. The **Copy** button creates a new model based on the family model that was active when the **Copy** button was clicked. You are prompted to provide a name for the new model. Clicking the **Delete** button causes the active model to be deleted.



Note

Points can be added to the **Review Model Data** table in order to influence the model curve. When entering data you need only enter Age and PCI values.

Review Model Data

This card presents data used to create the family model. Like other tables in PAVER, the extended features can be accessed by right-clicking on the table. The **Status** column contains no entry for records that are used to calculate the condition prediction curve. Points that are removed from the prediction process by boundary conditions or outlier analysis are labeled as "Out of Range" or "Outlier" points. You can add points to this table if you wish to influence the curve in a particular area. If any records are added or deleted, you must recalculate to refresh the graph.

Use Boundary/Outlier

Note

In order to edit **Use Boundary/Outlier** or **Collect Model Data** tabs, make sure the check box next **Prevent Changes to Model** in the **Options** tab is unchecked.

Upper and lower model boundaries are specified on the **Use Boundary/Outlier** card. Age vs. PCI points that fall outside the boundaries are marked as "Out of Range" in the **Review Model Data** table and are not considered when the predicted condition function is estimated. Points marked as "Out of Range" can be reintroduced into the analysis by turning off the boundaries or shifting the location of the boundaries so those points are in the allowable range. The **X Range Filter** is used to specify a range on the x-axis from which you want to include data. Data points outside the range you specify are ignored.

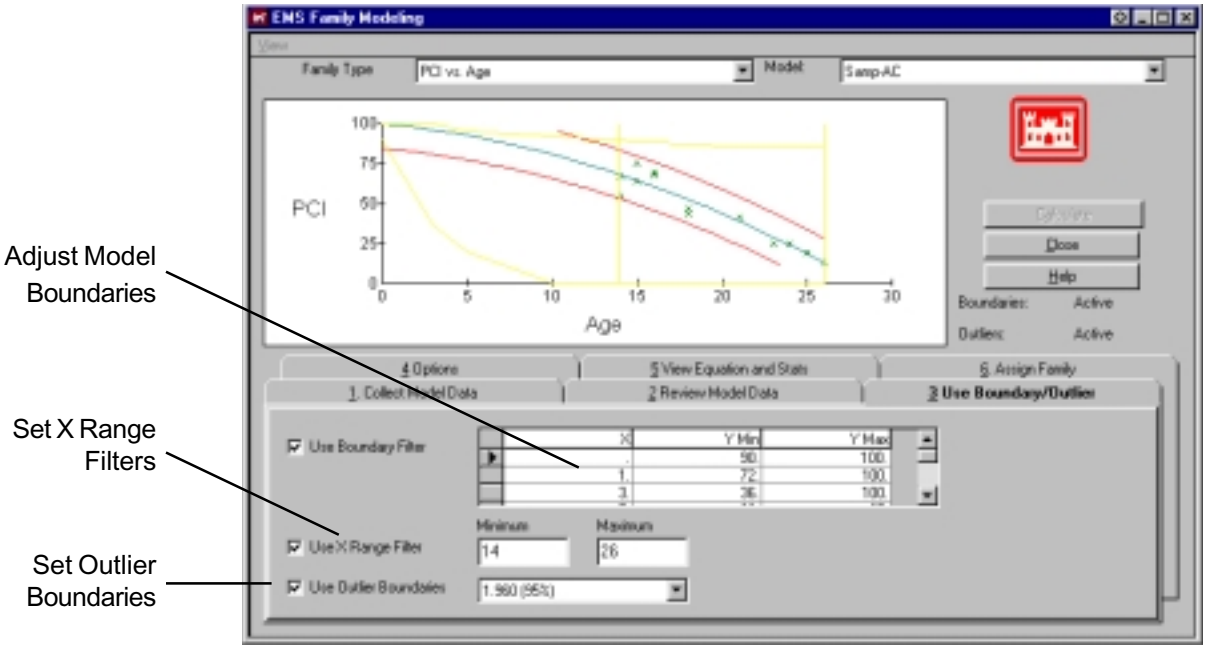
Model boundaries are adjusted by changing the values in the table on the **Use Boundary/Outlier** card. To edit or change a value, highlight the row in the table you want to change. Then, select the column you wish to edit (year, lower or upper bound) and type the new value (numeric entries only).

Note

To add or delete rows of boundary data, right click on the table.

New rows can also be added to the table with the right click menu. The **Add** option inserts a blank row in the last row of the boundary data table. Records in the boundary data table are sorted in ascending order by age (year). Edited and new records are out of order until the model is recalculated. You can force a recalculation of the model by activating any of the other index cards and then clicking the **Calculate** button. After the model is recalculated, the boundary table entries will be in proper sort order.

You can also set **X Range Filters** - minimum and maximum. Finally, the outlier boundaries are used to limit the number of data points used in the computation of the curve. Options for outlier constraints range from 50 to 100 percent. Changing these various options and recalculating produces different curve results. Use tab **5. View Equation and Stats** to determine the statistical soundness of your curve.



Options

The **Options** card is the heart of the statistical analysis performed in the prediction modeling tool. In the "Slope" section, you can choose to constrain the curve upward or downward, or leave it unconstrained. You also set the critical PCI for all sections assigned to this model by entering the value you wish in the "Critical Condition" window. To prevent changes to the model select the check box associated with the label **Prevent Changes to the Model**.

View Equation and Stats

The **View Equations and Stats** card displays the intercept and coefficient values for the equation estimated to be the best fit for the data. The card also lists various "goodness-of-fit" statistics for the estimated model.

Assign Family

Once a new family model has been completed, the **Assign Family** card can be used to assign the active family model to the pavement sections that were used to create the model. When you select the **Assign Family** card, the program checks the contents of **Review Model Data** card to build a list of the sections used to estimate the current family model. When you select the **Assign Family** card, the program first checks whether any sections in the current database are assigned to the selected **Family Model**. If the **Family Model** is not assigned to any sections, a message comes up indicating both that there are currently no sections assigned this model and asking whether you would like to assign the sections used to build the model (i.e. sections that fit the selection criteria on the **Collect Model Data** card). You may choose to assign these sections to the current family or continue without assigning the family to the sections.

Once the **Assign Family** card is active, the card contains a table and two buttons. The table lists the pavement sections in your database that are assigned the current family model. The two buttons arrayed on the card below the **Assign Family** table, **Add Members to Family** and **Remove Current Members**, are used to edit the pavement sections assigned to the current family model. To drop a section from the current family, highlight the section in family assignment table and click **Remove Current Member**. The section that is dropped is assigned the default family. The **Add Members to Family** button launches the same process as the **Edit Selection** routine on the **Collect Model Data** card. When you click the **Add Members to Family** button, the **EMS Query Tool** appears. You can use the **EMS Query Tool** to identify the sections you would like to assign the active family model to. When you have completed the query, the selected sections are added to the **Assign Family** table.

Other Condition Prediction Model Features

When the **Prediction Model** is open, a **View** menu appears at the top of the window. This option allows you to turn on and off various graphing features including **Boundaries**, **Outliers**, **Good Points**, and **Bad Points**. These features only affect the view of the data, not the underlying statistical routines. For example, if you use the view menu to turn off the boundaries, the boundaries do not appear on the plot of the graph. However, points in the model that do not meet the boundary conditions are still excluded from the modeling process.

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